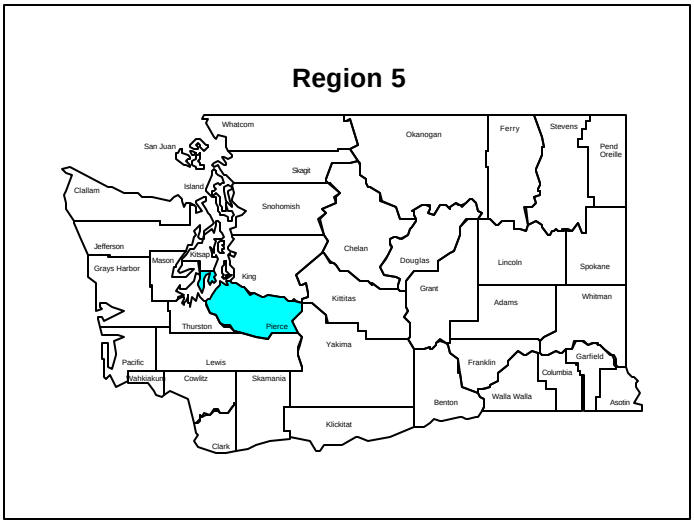
Region 5

Pierce County is the only county in Region 5. It is southernmost of the four counties referred to as the central Puget Sound region (the others being King, Snohomish, and Kitsap).[1]

Pierce County has an area of 1,675 square miles, 23rd in size among Washington's 39 counties. Its population in 2000 was 700,820, ranking second in the state behind King County. Population density of 418 people per square mile makes Pierce County the fourth most densely populated county.

About 55 percent of its residents live in incorporated areas, which grew 57 percent during the 1990s, in part, from incorporation of new cities and towns. Tacoma is the largest city, followed by Lakewood, Puyallup, and University Place. The fastest growing cities in the county in the 1990s were DuPont (248 percent growth), Gig Harbor, South Prairie, and Orting (between 90 and 100 percent growth). The Puyallup Tribe has a reservation in the Tacoma area.



The topography of Pierce County runs from sea level along its Puget Sound exposure to more than 14,410 feet at the summit of Mount Rainier. Western Pierce County is primarily flat plains near sea level; this is where most economic and population growth has occurred. Two prominent salt-water features in the county are a deep-water harbor at Commencement Bay and The Narrows, a strait that separates the county with parts of the Kitsap Peninsula under its jurisdiction. Several islands – including McNeil, Fox, Anderson and Herron – lie within county waters. The division between west and east Pierce County generally marks the transition from the plains to the foothills of the Cascade Range. In east county is Mount Rainier National Park and parts of the Gifford Pinchot National Forest.

The county's natural features heavily influence its boundaries. The Nisqually River separates Pierce County from Thurston and Lewis Counties on the south, and the Green and White Rivers separate it from King County to the north. The Pacific Crest Trail in the Cascade Mountains represents its eastern border with Yakima County. The county's northwest boundary extends into Puget Sound, which separates it from Kitsap County.

Major rivers in Pierce County include the Nisqually, Puyallup, White, and Carbon, all of which flow off of Mount Rainier and through Pierce County before emptying into Puget Sound. Lake Tapps is the largest of the hundreds of small fresh-water ponds and lakes that dot the county landscape. Other large bodies of fresh water are Bonney Lake, American Lake, Lake Steilacoom, and Gravelly Lake.

Pierce County's economy began with fur trapping and trading in the 1820s and 1830s, moved to fishing, farming and logging in the 1850s, eventually transforming into a diversified economy that now generally mirrors the state as a whole. During the 1990s, the county's economic growth outpaced the state. The services and trade sectors are the largest of the county's economy, accounting for about two-thirds of employment. The county has a significant military presence, with 38 percent of all military personnel statewide at Fort Lewis and McChord Air Force Base. Education, with two private four-year universities, four two-year colleges, and a branch campus of the University of Washington, also plays a significant role in the county's economy.

Population and Demographics

Table 1, below, shows Pierce County's population grew at a rate close to the state as a whole during the 1990s. The county is projected to maintain a growth rate similar to the state through 2025.

Table 1. Population Growth

	1990 Population	2000 Population	% Change	2025 (Projected)	% Change from 2000
Pierce	586,203	700,820	19.5%	942,157	34.4%
Washington State	*4,866,663*	*5,894,121*	*21.1%*	*7,975,471*	*35.3%*

Source: U.S. Census Bureau, Census 2000; *2002 Population Trends*, State of Washington Office of Financial Management, Forecasting Division; *Washington State County Population Projections For Growth Management*, Intermediate Projection, State of Washington Office of Financial Management, Forecasting Division, January 2002.

Table 2, below, shows that 92 percent of Pierce County's population lives in densely settled urbanized areas, a much greater percentage than the state as a whole. The current growth pattern, both urban and rural, affects how agencies prepare for emergencies as changes in the population and development can increase risks associated with hazards.

Table 2. Urban/Rural Populations, 2000

	Urban	Rural
Pierce	645,516	55,304
Percentage	92.1%	7.9%
Washington State	*81.9%*	*18.1%*

Source: U.S. Census Bureau, Census 2000: Population and Housing by Urban Classification.

The ability to prepare for and recover from a disaster varies among population groups. Research on various population groups and disasters found that it took some populations longer to recover from a disaster for a variety of reasons. These population

groups include minorities, people with language barriers, the disabled, the elderly, and those with low income.

Ethnic Groups

People from non-white population groups generally experience longer recoveries due to lower incomes, savings and insurance; their difficulty accessing insurance; and their using aid and relief organizations differently than was anticipated. Language and cultural differences can pose difficulties in some populations understanding and implementing preparedness and mitigation actions as well as accessing and using available disaster relief.

Table 3, below, shows that Pierce County is slightly more diverse than the state as a whole; its racial and ethnic characteristics shifted slightly during the 1990s. The white population decreased from 83 percent in 1990 to 80 percent in 2000. Ethnic groups showing the greatest growth in the1990s were Asian and Pacific Islanders (63 percent growth) and Hispanics (40 percent growth). The primary Native American population was the Puyallup Tribe.

Table 3. Population by Ethnic Group

	Hispanic/ Latino	Asian	African American	Native American	Total
Pierce	5.5%	5.1%	7.0%	1.4%	19.0%
Washington State	*7.5%*	*5.5%*	*3.2%*	*1.6%*	*17.8%*

Source: U.S. Census Bureau, Census 2000.

A sizable percentage of the Pierce County population does not speak English as its primary language at home and speaks English less than very well, as shown in Table 4, below. This means that a significant segment of the population may have a language barrier that prevents them from preparing for a disaster, responding to an event, or applying for assistance after a disaster.

Table 4. Primary Language Spoken at Home

	Language Other Than English	*English Less Than Very Well*	Spanish	*English Less Than Very Well*	Other Indo-European	*English Less Than Very Well*	Asian-Pacific Islander	*English Less Than Very Well*
Pierce	**11.8%**	**4.8%**	3.8%	1.5%	2.9%	0.8%	4.8%	2.5%
WA State	***14.0%***	***6.4%***	*5.8%*	*2.8%*	*3.2%*	*1.3%*	*4.4%*	*2.2%*

Source: U.S. Census Bureau, Profile of Selected Social Characteristics: 2000

Disabled People

People with disabilities often are left out of community preparedness activities for a disaster. They have complex challenges because of hearing, sight, mobility, or mental impairments. Additionally, a significant percentage of working-age people with disabilities do not work. These factors make it difficult for the disabled to prepare in advance of a disaster.

Table 5, below, shows that one in five working-age adults in Pierce County have a disability that does not require them to be institutionalized, but just over half are employed. More than two of every five people of retirement age have a disability.

Table 5. Non-Institutionalized Disabled Population

	21 to 64 Years		65 Years and Older
	% of Population	% Employed	% of Population
Pierce	20.4%	58.3%	44.0%
Washington State	*17.7%*	*57.6%*	*42.3%*

Source: U.S. Census Bureau, Profile of Selected Social Characteristics: 2000.

Senior Citizens

Senior citizens may be overlooked in preparedness and recovery activities; their age could lead them to have trouble after a disaster, perhaps not qualify for loans, or become disabled because of the disaster. Table 6, below, shows that one of every 10 people living in Pierce County is over 65 years of age.

Table 6. Population Over Age 65

	% of Total Population
Pierce	10.2%
Washington State	*11.2%*

Source: U.S. Census Bureau, Census 2000.

Poverty

The amount of money people have influences what type of housing they live in, whether they can engage in mitigation actions, and how long it takes to recover. Income is based on a number of factors, including the individual, the economy, availability of jobs, educational opportunity, among others. Expenses can vary by location – rural places are cheaper to live but have fewer jobs, while urban areas can be costly, even for renters.

Table 7, below, shows about 1 in 10 people in Pierce County lives in poverty, about the state average.

Table 7. Poverty Rates

	% of Total Population	Children Under 18	Over Age 65
Pierce	10.5%	13.2%	7.2%
Washington State	*10.6%*	*13.2%*	*7.5%*

Source: U.S. Census Bureau, Profile of Selected Economic Characteristics: 2000.

School Children

While children overall are captured in figures elsewhere in this profile, the number of children attending school is a concern because many of the school buildings they spend considerable time in each day are older and potentially more vulnerable to the effects of disaster. Table 8, below, shows the population of school-age children in Pierce County; it does not show the number that are in potentially vulnerable buildings.

Table 8. School Enrollment – Kindergarten through High School

	Total	Kindergarten	Elementary	High School
Pierce	142,171	10,414	89,011	42,746
Washington State	*1,127,448*	*82,637*	*697,192*	*347,619*

Source: U.S. Census Bureau, Profile of Selected Social Characteristics: 2000.

Housing

Washington's Growth Management Act encourages local jurisdictions to direct population growth into urban growth areas, where growth and higher densities are expected and supported by urban services. It also requires communities to incorporate mitigation by protecting critical areas and restricting development in areas such as those that are frequently flooded or subject to geologic hazards. Eliminating or limiting development in hazard-prone areas can reduce vulnerability to hazards and the potential loss of life and injuries and property damage.

Table 9, below, provides a breakdown of various housing characteristics in Pierce County.

Table 9. Housing Development

	Median Value Owner-Occupied	Single-Family	Multi-Family	Mobile Homes	Other
Pierce	$149,600	67.1%	24.7%	7.9%	0.3%
Washington State	*$168,300*	*65.4%*	*25.6%*	*8.5%*	*0.5%*

Source: U.S. Census Bureau, Profile of Selected Economic Characteristics: 2000.

The year housing was built is important for mitigation. The older a home is, the greater the risk of damage from natural disasters. Homes built after 1980 are more likely built to current standards for hazards such as floods, high winds, snow loads, and earthquake. Table 10, below, shows the periods during which housing was built throughout the region.

The age of Pierce County's housing stock mirrors the state average, with about four in ten housing units constructed since 1980.

Table 10. Housing – Year Built

	Pre-1939 – 1959	1960 – 1979	1980 – 2000
Pierce	28.1%	32.7%	39.2%
Washington State	*29.4%*	*32.7%*	*37.9%*

Source: U.S. Census Bureau, Profile of Housing Characteristics 2000

Household Income

Median household income is an indicator for a region's economic stability. It can be used to compare economic areas as a whole, and it generally shows how income is distributed among the population. Median household income indicates that point where half of all households have a higher income, and half have a lower income.

Table 11, below, shows median household income in Pierce County is slightly higher than the state average.

Table 11. Median Household Income

County	Year 1999
Pierce	$45,204
Washington State	*$44,776*

Source: U.S. Census Bureau, Profile of Selected Economic Characteristics: 2000

Employment and Industry

The economy of Pierce County is diverse, though more heavily dependent on the services and trade sectors than the state as a whole. Below is a brief description of the Pierce County economy and employment.

The services sector is the largest in the county, with 35 percent of employment; it has been the fastest growing sector since 1970. Besides agriculture, this sector pays the lowest average wage. Health care is the largest industry in the sector, with 32 percent of jobs. Business services is second, with 13 percent of jobs; the largest segment is temporary help agencies and building maintenance workers.

Trade has 31 percent of the county's jobs. The largest segment is food and beverage service, followed by food and general merchandise stores.

Government has a larger share of employment in Pierce County than the state as a whole, with 25 percent of jobs compared to 20 percent for the state. This primarily is due to significant federal employment (about 19,000 active duty and 7,900 civilian jobs) at the two military bases. State government also is a major employer, with two state prisons, two large social and health service institutions, four two-year colleges, and a university branch campus.

Manufacturing plays a significant role in Pierce County, with 13 percent of jobs, slightly less than the state average. The largest industry is lumber and wood products, followed by transportation equipment (related to aircraft production), printing and publishing, industrial machinery/computer equipment, and food processing.

While the transportation, communications, and public utilities sector is slightly smaller than the state average, Pierce County has a significant marine transport industry. The Port of Tacoma is the second largest port in the state, and among the top 25 container ports in the world; cargo handling, trucking and warehousing primarily related to the port account for 16 percent of this sector's jobs.

Commuting Patterns[2, 3, 4]

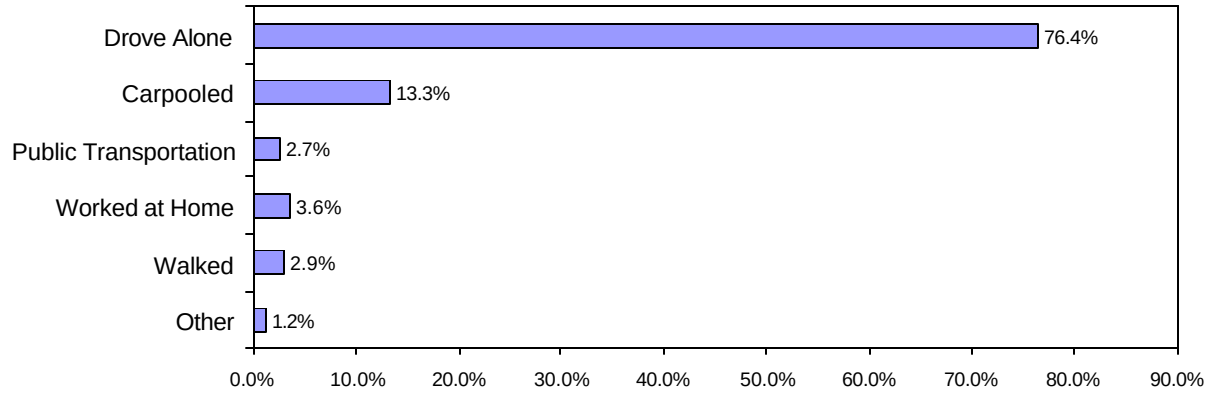
Recent population growth has resulted in a significant increase in workers, automobiles and trucks on the roads. A higher percentage of workers driving alone can cause traffic congestion and accidents. More traffic places a larger load on the region's transportation infrastructure. The impact of an emergency can disrupt automobile traffic, shut down transit systems, and make evacuations more difficult.

About one in four Pierce County's workers – about 80,000 in 1999 – commute to other counties, primarily King County, for employment.

Figure 1, below, shows transportation used by commuters. Primary mode of transportation is driving alone. Pierce Transit, the public bus system in Pierce County carried 14 million riders in 2001. Vanpools carried 600,000 passengers in 2001. Sound

Transit's Sounder commuter rail line carried 610,218 passengers in 2002 between Tacoma and Seattle; the line has three stops in Pierce County and three in King County. Sound Transit also operates express bus service between Pierce and King Counties; ridership figures for 2001 are not immediately available. The state ferry system carried 761,532 passengers and 320,724 vehicles between Tacoma and Vashon Island in 2002.

Figure 1. Commuting Patterns



Source: U.S. Bureau of the Census, Profile of Selected Economic Characteristics 2000

Hazards and State Facilities Potentially At-Risk

The regional hazard profiles were developed using information from the individual hazard profiles that are part of the Risk Assessment, as well as from reference documents listed at the end of each hazard profile.

Unless otherwise noted below, at-risk facilities were identified by state agencies participating in this plan using methodology identified in the Risk Assessment Introduction, Tab 7.

Figures for the number of staff/visitors/residents for each at risk facility were calculated on the highest use for that facility; for many structures, this inflates the number of individuals in the buildings at any one time.

The Washington Department of Transportation identified essential transportation corridors, or highways and ferry routes of greatest importance to transportation of people and goods and services.

Region 5

Hazard: Avalanche

Characteristics	Most Vulnerable Areas	Event History	Probability
Avalanches occur when a layer of snow loses its grip on a slope and slides downhill. They occur frequently in the backcountry of the Cascade Range, often without any impact to people, transportation routes or development. Most avalanches that cause injuries or deaths occur outside developed recreation areas; the primary cause of these avalanches is the weight of the victim or someone in the victim's party on the slab of snow. Very few avalanche fatalities occur in on open runs in ski areas or on highways. Avalanche season begins in November and runs through early summer for all mountain areas of the state; in high alpine areas of the Cascade Range, the season is year-round.	1. Recreation areas in the Cascade Mountains. 2. Slopes of Mount Rainier. 3. Chinook Pass, State Route 410 (closed to traffic in winter). 4. Cayuse Pass, State Route 123 (closed to traffic in winter).	Avalanches in Region 5 since 1910 that resulted in fatalities include those that occurred in 1958 at Silver Creek near Mount Rainier (one death), 1981 on Mount Rainier (19 deaths, 18 injured), 1988 on Mount Rainier (three deaths), 1992 on Mount Rainier (two deaths), 1998 on Mount Rainier (one death, several injured), and 2002 at Crystal Mountain (one death).	On average, avalanches kill one to two people every year in Washington State. Twenty-seven avalanche deaths have occurred in Region 5 since 1910.

Region 5

Hazard: Avalanche **At Risk Population:** Unknown of 700,820 **PRELIMINARY ASSESSMENT**

State Agency Structures At Risk Number and Function of Buildings	No. of Affected Staff / Visitors / Residents	Approx. Value of Owned Structures	Approx. Value of Contents All Buildings
Total at-risk buildings: Two state highways, no state facilities.	0	0	0
Total at-risk critical facilities: No state facilities.	0	0	0

Function of at-risk buildings: Two state highways are potentially at risk to avalanche:

1. Chinook Pass, State Route 410 (closed to traffic in winter).
2. Cayuse Pass, State Route 123 (closed to traffic in winter).

Region 5

Hazard: Drought

Characteristics	Principal Sources	Event History	Probability
Drought is a prolonged period of dryness severe enough to reduce soil moisture, water and snow levels below the minimum necessary for sustaining plant, animal, and economic systems. Drought can have a widespread impact on the environment and the economy, depending upon its severity, although it typically does not result in loss of life or damage to property, as do other natural disasters. In Region 5, drought conditions can reduce water available for crops and domestic and industrial use, as well as affect the availability and cost of power for local industries.	Drought is the result of many causes, often synergistic in nature; these include global weather patterns that produce persistent, upper-level high-pressure systems along the West Coast with warm, dry air resulting in less precipitation.	During 1895-1995, much of the state was in severe or extreme drought at least 5 percent of the time. Region 5 was in severe or extreme drought from 5 to 10 percent of the time during this period. 1977 Drought – This region experienced severe or extreme drought conditions between 10 to 20 percent of the time during this event. 2001 Drought – At the height of the event in March 2001, much of this region experienced moderate or severe drought conditions.	In temperate regions of the world, including Washington state, current long-range forecasts of drought have limited reliability. Meteorologists do not believe that reliable forecasts are attainable any more than a season in advance. Drought conditions of at least moderate severity occur every few years in Washington. On a long-term basis, Region 5 experiences drought conditions of at least moderate severity from 5 to 10 percent of the time.

Region 5

Hazard: Drought **At Risk Population:** Unknown of 700,820 **PRELIMINARY ASSESSMENT**

State Agency Structures At Risk Number and Function of Buildings	No. of Affected Staff / Visitors / Residents	Approx. Value of Owned Structures	Approx. Value of Contents All Buildings
Total at-risk buildings: No state facilities.	0	0	0
Total at-risk critical facilities: No state facilities.	0	0	0

Region 5

Hazard: Earthquake

Characteristics	Principal Sources	Event History	Probability
In general, Seismic Hazard Areas in Region 5 are found in: Areas near the Tacoma fault. Floodplains and the adjacent bluffs in the Carbon, Nisqually, Puyallup and White River valleys because of their high or medium susceptibility to liquefaction and other ground failures. Bluffs along shorelines, including those along the Puget Sound, because of their susceptibility to landslides and other ground failures. Shorelines of Puget Sound and large lakes, because of their susceptibility to tsunamis and seiches.	1. Interplate earthquake in the offshore Cascadia Subduction Zone. Evidence of quakes with magnitude greater than 8 have been found along the Washington coast; the most recent event was about 1700. 2. Shallow, crustal earthquake in the North America (continental) plate. One major fault runs through Region 5, the Tacoma fault. Scientists are studying this fault to determine how likely it is to produce earthquakes and their size. 3. Deep, Benioff zone earthquake within the Juan de Fuca plate. This is the source for the 1949, 1965, and 2001 earthquakes.	Since 1970, earthquakes of magnitude 4.0 or greater whose epicenter was in Region 5 occurred in 1988 (M4.1), 1995 (M4.1), and 2001 (M6.8, M4.3). The region received Presidential Disaster Declarations for the M6.5 Seattle-Tacoma earthquake in 1965 and the M6.8 Nisqually earthquake in 2001. The region experienced significant damage during the M7.1 Olympia earthquake in 1949.	Approximate recurrence rate for a magnitude 9 earthquake in the Cascadia Subduction Zone is once every 350 to 500 years. Approximate recurrence rate for the quakes similar to the 1965 magnitude 6.5 Seattle-Tacoma and 2001 magnitude 6.8 Nisqually quake is once every 35 years. Approximate recurrence rate for the 1949 magnitude 7.1 Olympia earthquake is once every 110 years. Geologists are continuing to study the Tacoma fault and have not yet determined potential size or recurrence intervals for earthquakes on the fault. However, they say a M6.5 or greater earthquake on a shallow, Puget Lowland fault occurs about once every 333 years.

Hazard: Earthquake **At Risk Population:** est. 553,475 of 700,820 **PRELIMINARY ASSESSMENT**

State Agency Structures At Risk Number and Function of Buildings	No. of Affected Staff / Visitors / Residents	Approx. Value of Owned Structures	Approx. Value of Contents All Buildings
Total at-risk buildings: State Agency identified – 268 (207 owned, 61 leased)	15,511	$662,084,470	$235,399,071

Function of at-risk buildings: Included in the state facilities potentially at-risk to earthquakes are the following:

- University of Washington branch campus in Tacoma, and its Pack Forest learning center.
- Campuses of Rainier School and Western State Hospital for individuals with physical and mental disabilities.
- Special Confinement Center for sexual offenders.
- Child Study and Treatment Center.
- About 70 general office and client service offices that include local detachments, highway weigh scales, crime lab, and communication facilities of the Washington State Patrol, and facilities serving individuals and families on public assistance, providing employment and training services, driver licensing, and liquor sales.

Three state highways considered emphasis corridors because of their importance to movement of people and freight are potentially at risk to earthquake:

1. Interstate 5
2. State Route 16
3. State Route 167

Total at-risk critical facilities: State Agency identified – 100 (80 owned, 20 leased)	6,295	$389,018,480	$173,836,152

Function of at-risk critical facilities: Included in the state facilities potentially at-risk to earthquakes are the following:

- Buildings on the campuses of Rainier School and Western State Hospital for individuals with physical and mental disabilities.
- Special Confinement Center for sexual offenders.
- Child Study and Treatment Center.
- General office and client service offices that include those serving individuals and families on public assistance, providing employment and training services, driver licensing, and liquor sales.

Region 5

Three state highways considered emphasis corridors because of their importance to movement of people and freight are potentially at risk to earthquake:

1. Interstate 5
2. State Route 16
3. State Route 167

Region 5

Hazard: Flood

Characteristics	Principal Flood Sources	Event History	Probability
Region 5 is subject to two types of flooding – flooding that occurs on the county's major river systems (see right) and flooding that is the result of urbanization, particularly in small stream basins. Because of their origins in upper elevations, these rivers are influenced by snow and rain patterns in the Cascade Mountains; flooding is most likely to occur from November through February during periods of heavy rainfall and rapid snowmelt. All four rivers travel through broad floodplains with long histories of flooding. Bank erosion is also a threat on the rivers.	1. Carbon River 2. Nisqually River 3. Puyallup River 4. White River	Flooding in Region 5 is a common event. Since 1956, flooding resulted in Presidential Disaster Declarations in 1962, 1964, 1972, 1975, 1977, 1986, 1990 (3 disasters), 1995, 1996, 1997, and 2003. Since 1989, more than $22.8 million in Stafford Act disaster assistance has been provided to Region 5 for repairs to public facilities following flood events. (Note: Figures do not include October 2003 flood disaster; assistance programs still being administered.)	The region's rivers typically flood every two to five years. Since 1956, this region has experienced serious flooding resulting in major damage and a Presidential Disaster Declaration about every four years. The region has 4.2 percent of its area in the 100-year floodplain.

Region 5

Hazard: Flood **At Risk Population:** est. 177,684 of 700,820 **PRELIMINARY ASSESSMENT**

State Agency Structures At Risk Number and Function of Buildings	No. of Affected Staff / Visitors / Residents	Approx. Value of Owned Structures	Approx. Value of Contents All Buildings
Total at-risk buildings: State Agency identified – 85 (72 owned, 9 leased)	1,786	$138,432,033	$99,422,181

Function of at-risk buildings: The campus of the Rainier School for mentally disabled adults, and general office and client services offices, including liquor stores and driver licensing offices.

Two state highways considered emphasis corridors because of their importance to movement of people and freight are potentially at risk to flood where they cross or run through floodplains:

1. Interstate 5, as it crosses the Puyallup River.
2. State Route 167, as it runs on top of the south levee and then crosses the Puyallup River.

Total at-risk critical facilities: State Agencies identified – 42 (39 owned, three leased)	886	$72,000,000	$63,540,244

Function of at-risk critical facilities: Buildings on the campus of the Rainier School for mentally disabled adults, and general office and client services offices.

Two state highways considered emphasis corridors because of their importance to movement of people and freight are potentially at risk to flood where they cross or run through floodplains:

3. Interstate 5, as it crosses the Puyallup River.
4. State Route 167, as it runs on top of the south levee and then crosses the Puyallup River.

Region 5

Hazard: Landslide

Characteristics	Principal Sources	Event History	Probability
Region 5 is part of two landslide provinces. Puget Lowland province – Unconsolidated material overlies the bedrock of much of the Puget Lowland. The lowland bluffs are susceptible to landslides because of their steepness, abundant rainfall and resulting groundwater, and contrasts in permeability of materials. Four landslides affect these bluffs: slumps, debris flows, ancient landslides in unconsolidated materials, and submarine landslides. Cascade Range province – Most peaks are lower south of Snoqualmie Pass than they are north of the pass, and they are made up of predominantly volcanic rock; earth flows and block slides in bedrock are the most common types of landslides in the southern Cascades.	1. Bluffs along shorelines of Puget Sound. 2. Foothills of the Cascade Mountains. 3. Cascade Mountains.	1894 – A submarine landslide in the Puyallup River delta caused a damaging tsunami that killed two people. 1949 – A landslide three days after the April 16 earthquake generated a tsunami in the Tacoma Narrows; the slide missed waterfront homes, but the tsunami damaged them. 1996 – Landslides damaged or destroyed eight homes and damaged utility lines; pushed two locomotives and two rail cars into Puget Sound, spilling 3,000 gallons of fuel; damaged State Route 165 and undermined a bridge abutment at the Carbon River near Carbonado. Winter 1996-1997 – About 20 to 30 landslides occurred in the region. One landslide cut phone service to Salmon Beach. 2001 – A landslide generated by the Nisqually earthquake, demolished two homes and damaged sewer, water and electrical lines at Salmon Beach. A much larger slide moved at the top of the bluff above the beach, threatening another eight homes.	Ground failures that result in landslides have a number of contributing factors that do not allow for the development of a reasonable estimate probability of future events. Factors that contribute to ground failure and landslides include: • Local topography. • Erosion on slopes. • Saturation of slopes. • Earthquakes. • Volcanic deposits and debris flows. • Excess weight on weak slopes. • Human action that disturbs slopes.

Hazard: Landslide **At Risk Population:** Unknown of 700,820 **PRELIMINARY ASSESSMENT**

State Agency Structures At Risk Number and Function of Buildings	No. of Affected Staff / Visitors / Residents	Approx. Value of Owned Structures	Approx. Value of Contents All Buildings
Total at-risk buildings: State Agency identified – 148 (126 owned, 22 leased)	7,248	$475,366,017	$201,773,457

Function of at-risk buildings: Included are the campuses of the Rainier School and Western State Hospital for the mentally disabled, and about 24 general office and client services offices.

Three state highways considered emphasis corridors because of their importance to movement of people and freight are potentially at risk to earthquake:

1. Interstate 5
2. State Route 16
3. State Route 167

Additionally, ferry landings on the Tacoma – Vashon Island routes are potentially at risk of ground failure due to their construction on poor soils on shorelines.

Total at-risk critical facilities: State Agency identified – 66 (all owned)	5,242	$359,000,000	$173,839,152

Function of at-risk critical facilities: Included are buildings on the campuses of the Rainier School and Western State Hospital for the mentally disabled.

Three state highways considered emphasis corridors because of their importance to movement of people and freight are potentially at risk to earthquake:

1. Interstate 5
2. State Route 16
3. State Route 167

Additionally, ferry landings on the Tacoma – Vashon Island routes are potentially at risk of ground failure due to their construction on poor soils on shorelines.

Region 5

Hazard: Severe Storm

Characteristics	Principal Sources	Event History	Probability
A severe storm is an atmospheric disturbance that results in one or more of the following phenomena: strong winds and large hail, thunderstorms, tornados, rain, snow, or other mixed precipitation. Most storms move into Washington from the Pacific Ocean. Typically, major impacts from a severe storm are to transportation and loss of utilities.	1. High winds 2. Winter storm 3. Tornado 4. Coastal flooding	Severe storm in Region 5 is a common event. Since 1956, severe storm events resulted in Presidential Disaster Declarations in 1962, 1975, 1977, 1990 (three disasters), 1993, 1995, 1996. Since 1989, Region 5 received more than $15.2 million in Stafford Act disaster assistance for repairs to public facilities following severe storm events.	Projected recurrence rates for the severe storm events to which Region 5 is most vulnerable are as follows: • High wind events occur once or twice a year. • Tornadoes occur about once every eight years. • Winter storms occur at least once every two years. • Coastal flooding occurs about once every 40 years in coastal areas.

Region 5

Hazard: Severe Storm **At Risk Population:** 700,820 of 700,820 **PRELIMINARY ASSESSMENT**

State Agency Structures At Risk Number and Function of Buildings	No. of Affected Staff / Visitors / Residents	Approx. Value of Owned Structures	Approx. Value of Contents All Buildings
Total at-risk buildings: State Agency identified – 255 (196 owned, 59 leased)	11,583	$582,753,270	$231,050,914

Function of at-risk buildings: Included in the state facilities potentially at-risk to earthquakes are the following:

- University of Washington branch campus in Tacoma, and its Pack Forest learning center.
- Campuses of Rainier School and Western State Hospital for individuals with physical and mental disabilities.
- Special Confinement Center for sexual offenders.
- Child Study and Treatment Center.
- About 70 general office and client service offices that include local detachments, highway weigh scales, crime lab, and communication facilities of the Washington State Patrol, and facilities serving individuals and families on public assistance, providing employment and training services, driver licensing, and liquor sales.

Additionally, the ferry landing in Tacoma is potentially at risk to severe storms due to its exposure to high winds and surf on exposed shorelines.

Total at-risk critical facilities: State Agency identified – 100 (80 owned, 20 leased)	6,295	$389,018,480	$173,836,152

Function of at-risk critical facilities: Included in the state facilities potentially at-risk to earthquakes are the following:

- Buildings on the campuses of Rainier School and Western State Hospital for individuals with physical and mental disabilities.
- Special Confinement Center for sexual offenders.
- Child Study and Treatment Center.
- General office and client service offices that include those serving individuals and families on public assistance, providing employment and training services, driver licensing, and liquor sales.

Additionally, the ferry landing in Tacoma is potentially at risk to severe storms due to its exposure to high winds and surf on exposed shorelines.

Hazard: Tsunami

Characteristics	Principal Sources	Event History	Probability
A tsunami resembles a series of quickly rising tides that withdraw with currents much like those of a river. Swift currents commonly cause most of the damage. A Pacific Ocean tsunami can affect the entire Pacific basin, while a tsunami in inland waters can affect many miles of shoreline. Tsunamis typically cause the most severe damage and casualties near their source. Waves are highest there because they have not yet lost much energy. Another class of damaging water wave is a seiche. A seiche is a wave generated in a body of water from the passage of seismic waves caused by earthquakes. Sedimentary basins beneath the body of water can amplify a seismic seiche and the natural sloshing action in a body of water or focus water waves onto a section of shoreline.	Tsunamis and seiches can be generated by a number of sources: 1. Distant earthquakes along the Pacific Rim (i.e., 1964 Alaska earthquake). 2. Local earthquakes, such as those generated by local surface faults; in the Benioff zone; or in the Cascadia Subduction Zone off the coast. 3. Large landslides into bodies of water, such as Puget Sound or lakes. 4. Submarine landslides in bodies of water such as Puget Sound.	1894 – A submarine landslide in the delta of the Puyallup River in Commencement Bay, Tacoma, generated a tsunami. These events carried away a railroad track and roadway, and resulted in two deaths. 1949 - A small landslide-generated tsunami struck the Point Defiance shoreline on April 16, three days after a M7.1 earthquake weakened the hillside. A 400-foot high cliff gave away and slid into Puget Sound. Water receded 20-25 feet from the normal tide line, and an eight-foot wave rushed back against the beach, smashing boats, docks, a wooden boardwalk, and other waterfront installations in the Salmon Beach area. The slide narrowly missed a row of waterfront homes struck by the tsunami. Additionally, evidence of a tsunami occurring in the past 2000 years has been found at Burley on the Key Peninsula.	Geologists have not yet determined size or recurrence intervals of earthquakes generated by the Tacoma fault. Estimated recurrence rate of an earthquake on the Seattle fault of the size necessary to generate a tsunami or seiche is estimated at once every 1,100 years. Work on tsunami inundation models and maps for the South Puget Sound area near Tacoma has not been scheduled.

Region 5

Hazard: Tsunami	**At Risk Population:** est. 55,900 of 700,820		**PRELIMINARY ASSESSMENT**
State Agency Structures At Risk **Number and Function of Buildings**	**No. of Affected Staff / Visitors / Residents**	**Approx. Value of Owned Structures**	**Approx. Value of Contents All Buildings**
Total at-risk buildings: State Agency identified – 3 (all leased)	231	0	$2,079,000
Function of at-risk buildings: General office and client service offices.			
Total at-risk critical facilities: State Agency identified – 3 (all leased)	231	0	$2,079,000
Function of at-risk critical facilities: General office and client service offices.			

Region 5

Hazard: Volcano

Characteristics	Volcanoes in Region	Event History	Probability
Region 5 is home the volcano considered most dangerous in the state – Mount Rainier. Volcanoes can lie dormant for centuries between eruptions; the risk posed by volcanic activity is not always apparent. When Cascades volcanoes do erupt, high-speed avalanches of hot ash and rock called pyroclastic flows, lava flows, and landslides can devastate areas 10 or more miles away, while huge mudflows of volcanic ash and debris called lahars can inundate valleys more than 50 miles downstream. Falling ash from explosive eruptions can disrupt human activities hundreds of miles downwind, and drifting clouds of fine ash can cause severe damage to the engines of jet aircraft hundreds or thousands of miles away. Mount Rainier is considered most dangerous because more than 150,000 people live on deposits from previous lahars generated by the mountain. It also is capped by more glacier ice than the rest of the Cascade volcanoes combined. Lahars are the greatest threat to communities below the volcano.	1. Mount Rainier	During the past 10,000 years, Mount Rainier has generated at least 60 lahars. Classed in order of decreasing size and increasing frequency, they are Case M, Case I, Case II, and Case III. Case M - The Osceola Mudflow, 10 times larger than any other known lahar from the volcano, occurred 6,000 years ago. Deposits extend at least as far as Kent and Tacoma. Orting, Buckley, Sumner, and Puyallup are wholly or partly located on Osceola deposits. Case I – Many of these flows, much smaller than the Osceola, have reached the Puget Lowland. The Electron Mudflow reached the lowland 600 years ago, leaving deposits 18 feet thick at Orting. Case II – More than a dozen have occurred in the past 6,000 years. A few have reached the Puget Lowland; the National Lahar inundated the Nisqually River valley to Puget Sound, and another filled the White River valley to Auburn. Case III – These flows, including glacial outburst floods, are small but occur frequently; they rarely move beyond the National Park boundary.	Lahars that reach the Puget Lowland occur every 500 to 1,000 years, with smaller flows not traveling as far occurring more frequently. Scientists believe there is a one in seven chance a lahar will reach the Puget Lowland in the average human lifespan if future lahars occur at rates similar to those of previous lahars. Recurrence rate for lahars flowing off Mount Rainier are as follows: • Case M – These lahars occur far less than once every 1,000 years. • Case I – These lahars occur about once every 500 to 1,000 years. • Case II – These lahars occur about once every 100 years. • Case III – These lahars can occur as frequently as once a year or as far apart as once every 100 years. Ash fall is not nearly as significant a threat as lahars. Due to prevailing westerly winds, the possibility of an annual ash fall of one centimeter in Region 5 from any major Cascade volcano ranges from 1 in 100 to 1 in 5,000, depending on location.

Hazard: Volcano **At Risk Population:** est. 107,250 of 700,820 **PRELIMINARY ASSESSMENT**

State Agency Structures At Risk Number and Function of Buildings	No. of Affected Staff / Visitors / Residents	Approx. Value of Owned Structures	Approx. Value of Contents All Buildings
Total at-risk buildings: State Agency identified – 249 (198 owned, 47 leased)	15,136	$659,341,044	$891,291,309

Function of at-risk buildings: Included in the state facilities potentially at- risk to the direct or indirect impacts of lahar or ash fall from a volcanic eruption are the following:

- University of Washington branch campus in Tacoma, and its Pack Forest learning center.
- Campuses of Rainier School and Western State Hospital for individuals with physical and mental disabilities.
- Special Confinement Center for sexual offenders.
- Child Study and Treatment Center.
- About 50 general office and client service offices that include local detachments, highway weigh scales, crime lab, and communication facilities of the Washington State Patrol, and facilities serving individuals and families on public assistance, providing employment and training services, driver licensing, and liquor sales.

Ten state highways are potentially at risk to volcanic eruptions that produce lahars in river valleys through which the highways traverse or they cross:

1. Interstate 5
2. U.S. Highway 99
3. State Route 7
4. State Route 161
5. State Route 162
6. State Route 165
7. State Route 167
8. State Route 410
9. State Route 512
10. State Route 706

Total at-risk critical facilities: State Agency identified – 86 (75 owned, 11 leased)	5,941	$388,871,520	$34,038,339

Function of at-risk critical facilities: Included in the state facilities potentially at-risk to the direct or indirect impacts of lahar or ash fall from a volcanic eruption are the following:

- Buildings on the campuses of Rainier School and Western State Hospital for individuals with physical and mental disabilities.
- Special Confinement Center for sexual offenders.
- Child Study and Treatment Center.
- General office and client service offices that include those serving individuals and families on public assistance, providing employment and training services, driver licensing, and liquor sales.

Two state highways considered emphasis corridors because of their importance to movement of people and freight are potentially at risk to volcanic eruptions that produce lahars in river valleys through which the highways traverse or they cross:

1. Interstate 5
2. State Route 167

Region 5

Hazard: Wildland Fire

Characteristics	Principal Sources	Event History	Probability
Wildland fires are fires caused by nature or humans that result in the uncontrolled destruction of forests, brush, field crops, grasslands, and real and personal property in non-urban areas. A fire needs three elements in the right combination to start and grow – a heat source, fuel, and oxygen. How a fire behaves primarily depends on the characteristics of available fuel, weather conditions, and terrain. The wildland fire season in Washington usually begins in early July and typically culminates in late September with a moisture event. Drought, snow pack, and local weather conditions can expand the length of the fire season.	1. Humans – people start most wildland fires; from 1992 to 2001, people, on average, caused more than 500 wildland fires each year on state-protected lands. Human-caused fires burn an average of 4,404 state-protected acres each year. 2. Lightning – lightning on average started 135 wildland fires annually on state-protected land during 1992-2001. Lightning-caused fires burn more state-protected acreage than any other cause, an average of 10,866 acres annually.	None of the state's most significant wildland fires occurred in Region 5, although smaller wildland fires have occurred in the region. Region 5 is part of the South Puget Sound fire protection region of the Washington Department of Natural Resources (this fire protection region also includes portions of Region 3 and Region 6). During 1992-2001, the South Puget Sound region averaged 182 fires a year that burned an average of 81 acres of state-protected lands (specific fire data for Region 5 is not available).	Nearly all of the state's significant wildland fires have occurred in Eastern Washington. Western Washington is less prone to catastrophic wildland fires than Eastern Washington – the east has both lighter fuels that burn more easily and more snags and hazard trees, and weather conditions more favorable to fire (thunderstorms with dry lightning are more prevalent in the east). Also, the west has a shorter fire season than the eastern half of the state – the west receives more rainfall, has wetter and cooler spring seasons, and is more urbanized.

Region 5

Hazard: Wildland Fire **At Risk Population:** est. 12, 310 of 700,820 **PRELIMINARY ASSESSMENT**

State Agency Structures At Risk Number and Function of Buildings	No. of Affected Staff / Visitors / Residents	Approx. Value of Owned Structures	Approx. Value of Contents All Buildings
Total at-risk buildings: State Agencies identified – 43 (owned-leased split not available)	872	$16,208,022	$1,496,800

Function of at-risk buildings: Included are the University of Washington's Pack Forest learning center, general offices and client services offices.

Total at-risk critical facilities: No state facilities.

[1] Unless otherwise noted, information in the narrative from *Pierce County Profile*, Washington Department of Employment Security, Labor Market and Economic Analysis Branch, March 2001.

[2] *Profile of Selected Economic Characteristics: Census 2000*, U.S. Census Bureau.

[3] *Traffic Statistics Rider Segment Report, January 1, 2002 through December 31, 2002*, Washington State Ferries.

[4] *Summary of Public Transportation 2001*, Washington State Department of Transportation, November 2002 (Revised April 2003).